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# Using IMPLAN to Identify Rural Development Opportunities

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## Research Summary

The U.S. Department of Agriculture, Forest Service has historically been concerned with the effects of its programs on rural communities. Agency emphasis has recently changed from promoting community stability through a stable timber supply to revitalizing and diversifying rural communities. However, local community leaders and Forest Service personnel do not always know which development opportunities might prove successful. Using concepts from the field of regional

economics and the tool of input-output analysis, this paper explores three development strategies: expanding and retaining the economic base, substituting local production for imported commodities, and exploiting urban-rural linkages.

The procedures developed in this study resulted from an iterative case study where procedures developed and tested in one community were improved and applied to another. Data came from the Forest Service's IMPLAN system and REIS data from the U.S. Department of Commerce, Bureau of Economic Analysis.

Before IMPLAN is used to help identify development opportunities for a community, the IMPLAN model used must accurately reflect the local economy. Procedures for validating the IMPLAN database, "ground truthing," improving regional trade estimates, and more are discussed. The case study presents some results from Malad City, ID, a ranching community in southeastern Idaho.

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# Using IMPLAN to Identify Rural Development Opportunities

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## Introduction

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The U.S. Department of Agriculture, Forest Service has historically been concerned with effects of its programs on rural communities. From legislative language in the Organic Act of 1897, to a concern with community stability under the Forest Management Act of 1944, to the more philosophical language in the 1990 RPA Program on Rural Development, the Forest Service's commitment has remained steadfast.

However, the nature of agency involvement with rural communities has changed. At one time, the Forest Service saw its role as contributing to community stability by paying special attention to sustained-yield forestry. In recent years, the need to manage for protection of endangered species and increased recreation has constrained timber harvests on National Forests. The ideal of promoting community stability through a stable timber supply has given way to land management policies that, all else being equal, have had a negative economic impact on wood products industries (Waters and others 1994). In response, the agency's community emphasis has evolved to that of revitalizing and diversifying rural communities. In "A Strategic Plan for the 90's: Working Together for Rural America" (Robertson 1990), one Forest Service goal is to develop and provide timely and current research and resource information on rural development opportunities.

But what are these opportunities? In many cases, local community leaders and Forest Service personnel do not know which development opportunities might prove successful. In "Forest Resource Strategies for Rural Development," Thomas (1992) identified seven strategies: (1) organizing for resource-based economic development and conservation, (2) targeting value-added processing, (3) targeting alternative goods and services from the forest resource, (4) enhancing productivity, (5) strengthening marketing, (6) promoting technology transfer, and (7) improving local human capital. Many efforts of Forest Service rural development practitioners fall into these categories.

However, little has been done to address the problem of identifying development opportunities by using

tools and methods of regional economic analysis. Such an approach would recognize that rural communities exist within a tiered framework of economically inter-related areas. According to central place theory, economic regions may be defined on the basis of functional economic areas; a region containing an urban center provides selected goods and services to a surrounding rural periphery. Opportunities for better understanding economic development in rural regions may stem from understanding those economic linkages.

Furthermore, in describing the economy of a rural community, regional economists carefully distinguish between basic and nonbasic economic activity. The extent to which these regional economic themes can be incorporated into identification of economic development opportunities in natural resource based communities in the West will be explored in this paper.

Our approach combines ideas from regional economics with the analytical tool of regional input-output analysis to operationalize community-specific development strategies (Jensen and others 1987). The technology of constructing regional input-output models has been revolutionized in recent years with the development of IMPLAN (Taylor and others 1993) by the Forest Service. This paper shows how IMPLAN (Impact analysis for PLANning) regional input-output accounts, when combined with regional economic theory, can be used to identify possible opportunities for rural economic development. Malad City, ID, provides illustrative case study results.

## Regional Economics and Rural Development Strategies

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Regional economics suggests at least three general approaches to rural economic development: (1) retention and expansion of the existing export base, (2) substitution of local production for imports, and (3) expansion of rural to urban economic linkages (a variant on export expansion). Before we elaborate these themes, we review the role of central place theory in economic development.

## Central Place Hierarchy

This study focused on identification of rural economic development opportunities, always mindful of possible economic opportunities resulting from central place geography. Central place refers to urban centers. The idea is that a geographic region will be characterized by a hierarchy of urban places, ranging from small rural towns to larger towns to major urban centers. Each community supplies certain goods and services, reflecting its role in the service area hierarchy. Major urban centers supply specialized goods and services, such as selected medical services, to the entire region.

Recognizing the economic linkage between rural communities and higher-ordered, central places in the functional economic region is important to identifying possible rural development opportunities. For example, rural economic opportunities might include goods or services markets such as tourism or outdoor recreation that stem from the central place. In the case of unemployed rural labor, seeking employment in an expanding central place labor market may make more sense than remaining in the rural labor market.

The notion of economic “spillovers” is the other reason central place geography is important in rural economic development. Secondary and induced economic effects (spillovers) stemming from direct effects in rural communities are likely to affect the rural community in a somewhat limited way. Instead, a large portion of those effects will spillover to higher-ordered central places in the functional economic area (Hamilton and others 1994). In other words, the economic impact of rural development in rural communities is likely to be manifested mainly in nearby urban places. This means that economically expanding rural communities generate increased opportunities for goods and services suppliers in the region, but outside the rural community. Similarly, economically contracting rural communities will affect service providers in central places in a negative way, as in the case of reduced timber harvests (Waters and others 1994).

Data for this project were organized to depict small, rural communities (the case study regions) as well as the major urban trade center in the functional region where the community was located. To do this, we identified and adopted a scheme of central-place, multi-county aggregates. Three such empirical schemes are known to exist: (1) U.S. Department of Commerce, Bureau of Economic Analysis economic areas, (2) U.S. Department of Agriculture, Economic Research Service commuting zones and labor market areas, and (3) Rand-McNally retail trade areas. We choose the 1977-based Bureau of Economic Analysis regionalization scheme to identify core communities and the surrounding rural periphery regions for the case study economies; the 1977 scheme was recently updated.

## Export Base

The export base of a regional economy consists of those goods and service sectors that sell a large portion of their products outside the region. Such industries are known as “basic” industries. Often the economic structure of a region is divided into two parts: basic and nonbasic. The nonbasic industries serve markets, such as consumption by households and basic industry, that are largely inside the region.

According to the export base theory of economic development, a region will specialize in those exports in which it has a comparative advantage (Tiebout 1962). The key to regional economic growth, according to export base theory, is to identify those industries in which the region enjoys a comparative advantage and pursue public policies that assist expansion of export base industries. Export base industries do not have to be commodity producers. For example, service sectors selling to tourists can be part of the export base.

A modern variant of the export base strategy is known as business retention and expansion. The idea is to identify those industries that make up the region’s export base and then undertake public policies to support and expand those industries. Expansion of export base industries leads to expansion of nonbasic industries through the “multiplier” or ripple effect.

The difficulty with identifying a region’s export base is that there are no publicly available data on trade flows (imports and exports) for sub-State regions in the United States. However, those data are routinely developed when regional input-output accounts are generated, as through IMPLAN, for any county or combination of counties in the United States. To evaluate the possible use of such accounts to identify regional trade in the form of imports and exports, we generated a procedure that would identify the current trade structure of a given case-study region as well as changes in trade characterizing the region through time. In this way, we would get a better understanding of the region’s economic base.

## Import Substitution

Economies are typically interconnected. Commodities produced in one region often use goods and services (inputs) imported from outside the region. This causes an economic leakage, because some of the receipts from sales to outside markets must be used to pay for imported inputs. “Import substitution” refers to replacing imported goods and services with goods and services produced in the local community. When economic leakages are plugged, the ripple effects from a given export base are strengthened. Import substitution, as an economic development strategy, has fallen out of favor in the international economic

development literature. Economists in favor of free trade are quick to point out that developing countries that followed an import substitution strategy invariably set up economic barriers to limit access to their domestic markets (Gillis and others 1992). Consequently, the protected domestic industries never became economically efficient. This can result in low product quality, relatively high prices, and the generation of profits primarily through rent-seeking behavior in the political arena. Overall, this pattern of economic development could not be sustained in the face of competition from the rest of the World.

In regional economic development, noncompetitive barriers to trade, so problematic in national policy, are a nonissue. It simply is not possible for regional governments to erect trade barriers; they do not have the political authority to make trade policy. The problem at the regional level is more practical: identifying the current import mix and deciding, out of that mix, which goods and services may be good candidates for import substitution. Imported commodities with large regional sales are obvious import substitution candidates for further study, as are imported commodities that may not offer a large market at the present time, but seem to be characterized by high rates of past growth that can continue into the future.

### Rural-Urban Linkages

The strategy of enhancing rural-urban linkages may be viewed as a subset of the classic export base expansion strategy. The basic theme is to first identify the rural community's export base and then relate that base to markets in nearby urban centers (Holland and others 1992). This strategy may lead to export enhancement in the form of increased sales from the rural community to the urban region. The idea is to identify the goods and services purchased by the larger urban economy and consider producing them in the local, rural community. This is a form of import substitution for the larger, regional economy and a form of export base expansion for the local, rural economy.

### Methods

The methods developed in this study resulted from an iterative procedure, where we developed and tested methods in one community, improved them, and applied them to another. We used data from the Forest Service's IMPLAN system along with the Bureau of Economic Analysis' (Regional Economic Information System) (REIS) data.

Forest Service rural development coordinators from the Northern (R-1), Intermountain (R-4), and Pacific Northwest (R-6) Regions were contacted and asked to recommend case study community locations to apply,

evaluate, and refine the methodology to identify development opportunities. They recommended 10 candidate communities from the rural, Northern Rockies. From these, we selected three communities, representing different kinds of economic base and industrial structures:

Community	Economy	Central Place
Choteau, MT	Ranching and recreation	Great Falls, MT
Malad City, ID	Ranching	Salt Lake City, UT
Republic, WA	Timber	Spokane, WA

Several features of these communities relative to the IMPLAN database should be noted. The IMPLAN system is based on county-level accounts. If an individual county's regional economic data are to be representative of a rural community, that community must economically dominate the county economy. In other words, the community must be the location of most of the income and employment in the county. This was the case for each of the case study communities, so even though we used county-level data to construct the regional accounts, the resulting economic models are largely representative of the dominant rural communities.

In general, it would be incorrect to use county-level data to model a given rural community because the county will typically contain several economically significant communities. Thus, IMPLAN-based county models are generally, and correctly, thought of as regional models that include several communities. However, in the sparsely populated rural West, data for selected counties can indeed be representative of a single community.

It should be noted that the option of constructing regional input accounts on a zip code basis has recently been added to IMPLAN (IMPLAN Group Inc. 1994). This was not an option when this study was conducted. By using zip codes rather than counties as the unit of analysis, it should be possible to more accurately depict an individual, small community economy. The ability to build true community-level models has been greatly enhanced by the recent additions to the IMPLAN database, making the procedures described in this document more relevant to the study of rural communities. However, there is some danger in building input-models for very small community economies. When there are very few firms in selected sectors in the model, the assumption of fixed proportion input-output relationships is more likely to be violated.

### Data Used

Required IMPLAN data were obtained from Dr. Eric Siverts, a regional economist formerly housed in the Forest Service's Land Management Planning Systems

Unit located at Fort Collins, CO. Additional regional data were obtained from REIS, State-level Departments of Employment Security, and the U.S. Department of Commerce, Bureau of the Census.

IMPLAN is a personal computer-based software program and regional database originally developed by the U.S. Forest Service (see Taylor and others 1993). The IMPLAN program is used with the IMPLAN regional database to construct regional economic accounts. IMPLAN data are available for every county in the United States. The IMPLAN database and software can be obtained from the Minnesota IMPLAN Group, Inc. (1940 South Greeley St., Suite 201, Stillwater, MN 55082).

The Regional Economic Information System is a system of regional data generated and maintained by the Bureau of Economic Analysis, U.S. Department of Commerce. The REIS county data on employment and personal income are available for every U.S. county for recent years on a CD-ROM available from Bureau of Economic Analysis. The REIS data are generally viewed as the most accurate source of regional economic information. These data can be obtained from several sources, but the easiest way is to contact the Bureau of Economic Analysis, Economics and Statistics Administration, U.S. Department of Commerce, Washington, DC 20230.

## Procedures

The basic approach was to exploit the sector (industry) detail and longitudinal features of the IMPLAN database. With IMPLAN, regional input-output accounts can now be constructed for selected years over a period starting in 1977. The IMPLAN database has been annually updated beginning in 1990. The intention was to use regional input-output accounts for the case study regions to study real (inflation-adjusted) changes in selected variables at a high level of sector detail.

IMPLAN allows the user to produce a number of optional input-output accounts. Analyses mostly used the IMPLAN Regional Trade Report (MID.005) and the Regional Final Payments Report (MID.107). The following discussion assumes the reader is familiar with the IMPLAN input-output system and its terminology. For additional information see Taylor and others (1993).

**Export Base**—Procedures for studying the export base of the rural region involved use of the IMPLAN Regional Trade Report to identify goods and service exports from the region and how those exports have changed through time. The Regional Trade Report estimates all exports and imports, by commodity, for the rural region. Data from 1982 and 1990 were analyzed with a spreadsheet. Both goods and services were given attention. Commodities (goods or services)

that experienced rapid rates of export growth were of special interest, because they are likely candidates for future expansion. Commodities with negative growth or no growth, which are also an important part of the existing export base, may be candidates for business retention efforts.

**Import Substitution**—For a given regional economy, the IMPLAN Regional Trade Report identifies regional imports by commodity at roughly the three-digit SIC level of sector detail. A Regional Trade Report was constructed to represent the economy in 1982 and 1990, the most recent year with data. Real changes in regional imports for each commodity were calculated by spreadsheet manipulation of the IMPLAN trade reports. We were especially interested in the current import structure and changes in that structure over time. Absolute changes, as well as rates of change (growth rates), were calculated. Commodities characterized by either high levels of imports or high rates of import growth over time became candidates for further study.

Additional screening, outside the IMPLAN accounts, involved consideration of economic competitiveness and factors influencing the economic viability of regional supply. Manufactured commodities requiring complex industrial processes or economies of large size were eliminated. For example, refined petroleum products are a large component of the import bill in nearly all rural communities, but are not likely candidates for import substitution given current technology. Also screened out were natural resource-based commodities associated with resource-based products known to be absent in the region. A region may import a large amount of lumber; but if there is no nearby log supply, then a sawmill is not likely to be a very good idea as an import substitution strategy. By screening the input-output trade accounts, we identified potential business (import substitution) opportunities, with as much product-specificity as the input-output trade data would support. Screening trade data is only an intermediate step in fully developing an import substitution strategy. Actual business opportunities are very product-specific and require detailed feasibility studies. This presumably would be done by community individuals or officials interested in starting or expanding a business.

**Rural-Urban Linkages**—The same Regional Trade Report used earlier for import substitution was used to identify possible opportunities for strengthening rural-urban trade center linkage (Robison 1992). Regarding the urban trade center, two questions need to be addressed: (1) What are the import requirements of the regional trade center? (2) How has the import bill been changing through time?

For each rural community studied, IMPLAN was used to identify the import structure of the associated urban trade center and how that structure has been changing through time. The procedure described for identifying commodity imports of the rural community was applied to the trade accounts for the urban trade center.

The export, or supply potential of the rural community was identified with the IMPLAN regional export accounts for the rural community. Based on the regional input-output model of the rural community, estimates of commodity exports from the rural community were obtained from the Regional Trade Report. These reports were analyzed to determine the current export structure, and how that structure has changed through time. The final step was to compare import markets in the urban core with commodity supply potential in the rural community for possible trade enhancement.

## Building an Accurate IMPLAN Model

By the time this study ended, we had learned a great deal about building an accurate IMPLAN model, conducting appropriate analyses, and where this information may fit in the rural community development process. Before any attempt is made to use IMPLAN to identify development opportunities for a community, the IMPLAN model used must accurately reflect the local economy. Economically small rural regions are difficult to model because of the problem of undisclosed data in national data collection systems.

**Regional Economic Information System Modification of IMPLAN Database**—The first step in using REIS data to correct the IMPLAN database is to construct a table based on REIS county-level employment estimates for the same year as the IMPLAN database. We refer to this table as the REIS Employment Table. It shows the number of jobs in each sector of the economy.

Then, construct a table of IMPLAN-based employment estimates aggregated to correspond to the one-digit REIS scheme—the IMPLAN Employment Table. The second table shows the number of jobs in each sector according to IMPLAN. The two tables must be reconciled. If there are deletions (undisclosed data) in several sectors of the REIS Employment Table, subtract all undeleted sectors from total employment to find the employment representative of the deleted sectors. For example, if a region has a single large mine, employment in the mining sector will be deleted. Usually, a phone call to the Forest Service District Ranger, U.S. Department of Agriculture, County Cooperative Extension Service, or district Department of Labor will give a good approximation of employment in the main industry.

When there are disclosure problems in REIS, stemming from only one or two firms in a given sector, employment in other sectors, such as the construction sector, will also be deleted to more fully protect the privacy and confidentiality of the firm(s) in the first sector. Obtain employment numbers gathered from informed local sources to fix identified sectors (such as large resource-based firms) in the REIS Employment Table, and estimate the other sector (such as construction) to be consistent with the REIS employment total. After verifying employment numbers in the county REIS table, use the procedures below to correct employment estimates in the IMPLAN Employment Table against the REIS employment estimates.

Produce the MID.107 reports, aggregate the local economy's employment into a one-digit SIC scheme, using the REIS-90 aggregation template provided by IMPLAN to develop the MID.404 report. Compare employment in the aggregated IMPLAN sectors from the MID.404 report with the one-digit REIS employment figures.

To prepare for “ground truthing” in the local community, employment in the REIS one-digit sectors should match employment in the aggregated IMPLAN sectors. If the employment figures do not match, change IMPLAN employment figures to be consistent with REIS figures. Additionally, each IMPLAN sector in a given aggregation should, when added across the aggregation, equal REIS total employment. The listing below identifies the crosswalk between REIS sectors and IMPLAN sectors.

REIS sector name	IMPLAN sector number
Farm	1-23
Agriculture, forestry, and fisheries services	24-27
Mining	28-47
Construction	48-57
Manufacturing	58-432
Transportation and public utilities	433-446
Wholesale trade	447
Retail trade	448-455
Finance, insurance, and real estate	456-462
Services	463-509, 525-527
Federal government—military	519
Federal government—civilian	513-515, 520
State and local government	510-512, 522-523

Use the REIS Employment Table and the MID.404 report to correct the MID.107 report for presentation to knowledgeable community members. We used the ratio of REIS employment to aggregated IMPLAN sectors' employment (from MID.404) to adjust employment estimates in the MID.107 report. Every sector

within the REIS aggregation scheme of the MID.107 report is multiplied by this ratio resulting in complete conformity of the MID.107 report to REIS one-digit sector employment, and total employment. The formula for spreadsheet use is:

$$\frac{\text{REIS Sector Employment}}{\text{Aggregate IMPLAN Sector Employment (MID.404)}} \times \text{IMPLAN Sector Employment (MID.107)}$$

For example, suppose IMPLAN Sector 31 (Gold Ores) estimated gold mining employment at 100 jobs; the REIS total employment in mining was 150 jobs, and IMPLAN’s total (aggregated) employment in mining was 200 jobs. Then the IMPLAN Sector 31 (Gold Ores) total of 100 jobs would be corrected to 75 jobs  $(=(150/200)100)$  as in the above equation to be consistent with the REIS estimate.

When presenting the corrected MID.107 report to informed community members during the “ground truthing,” any sector that shows zero employment should be deleted. IMPLAN sectors in which employment will always be zero include: 461, 516, 517, 518, 521, 524, and 528. Deletion of these sectors as well as any other sectors with zero employment will avoid information “overload,” and enable an easier and simpler portrayal of the local economy.

**“Ground Truthing” the Corrected IMPLAN Model**—Three documents are required to conduct ground truthing: (1) the corrected MID.107 Employment Table, (2) the IMPLAN 1990/1985 Database Documentation, and (3) the 1987 Standard Industrial Classification Manual (OMB 1987).

Verifying the corrected MID.107 IMPLAN report through an on-site visit to the local community (ground truthing) is the most crucial step in correction of the data of the IMPLAN model for the local economy. Use local individuals or citizen groups to conduct a line-by-line (sector by sector) assessment of the corrected MID.107 report estimated employment. Use the IMPLAN Database Documentation manual and the 1987 Standard Industrial Classification Manual (OMB 1987) to stimulate discussion and review of the IMPLAN employment profile of the local economy.

Local informed citizens will have a good sense of employment in nearly any sector in the MID.107 report, but they will be inclined to understate employment. Remind them that all people working in a sector, including office staff, janitors, and other employees perhaps not explicitly involved in the main activity of the industry are also included in employment figures. In addition, the employment estimates include full-time and part-time jobs. For example, the doctor and dentist industry IMPLAN Sector (490) may include nurses, receptionists, bookkeepers, hygienists, lab technicians, and janitors. Thus, only one doctor or dentist can offer significant employment to other associated

medical practitioners. Throughout the community interviews for each sector, the interviewer(s) must always be aware, and make the interviewees aware, of this comprehensive definition of employment within each sector.

Several sectors in small economies may not be accurately represented by IMPLAN. These sectors are:

IMPLAN sector number	IMPLAN sector name
502	Other nonprofit organizations
503	Business associations
504	Labor and civic associations
505	Religious organizations

Because of the nature of small communities and their economies, these sectors do exist, but are often staffed with volunteer labor. These sectors should be left in the MID.107 report, but closely scrutinized by community members; the estimated paid employment often will have to be adjusted downward or eliminated.

IMPLAN Sector 505, religious organizations, can be inaccurate in small communities. For instance, IMPLAN employment estimates were found to be overstated in communities with large Mormon (Church of Jesus Christ of Latter-Day Saints) populations, because the church relies on lay preachers. Sector 505 has exhibited other problems in the 1990 data, which do not appear to be completely predictable, so special scrutiny is warranted by the researcher and informed citizens.

Two sectors often understated or not represented by IMPLAN in small rural economies are: 499 (child day care) and 466 (beauty and barber shops). Pay special attention to these sectors, because they are both important sources of employment.

Sectors 491 (nursing and protective care) and 492 (hospitals) warrant special treatment in many small communities. Very often medical facilities are owned and operated by county or municipal governments. IMPLAN places the wages and salaries of employees from these establishments under Sector 523 (State and local government—noneducation). While this is correct from an accounting standpoint, it is often confusing to local citizens wanting to know why their hospital is not represented in the employment data. We concluded that the importance of these establishments can be more accurately reflected by moving the jobs, all components of value added, and industry output, out of Sector 523 and inserting them into Sector 491 nursing and protective care and/or Sector 492 hospitals. Talk directly with hospital or nursing home administrators to obtain a more precise notion of their relative importance. A similar problem occurs with Sectors 495 elementary and secondary schools and 496 colleges and universities. These sectors represent private schools only and should not be confused with public schools.

One or 2 days of the trip to the local community should also be spent doing a "windshield" survey of the local economy and conversations with residents. Often, evidence of industries not discussed during conversations with informed residents will be observed, especially activities that are not traditional in the area. Observation of existing businesses, including gas stations, retail stores, restaurants, and other traditional places of commercial activity, and conversations with local business people, will lend insight into the employment structure, trade patterns, and overall health and outlook of the local economy.

Continue investigating (telephone calls and visits) businesses that were noticed in the informal review, but were listed as having zero employment in the IMPLAN employment estimates. Promotional materials for businesses promoting tourism and other activities are often available at places of lodging, highway rest stops, or other sources. A local phone directory and a check of the Yellow Pages can yield useful information on local business activity. The local newspaper also provides a good source of information regarding real estate, retail goods, services, and many other aspects of trade and employment. While all of this information may not be directly involved in correcting the IMPLAN model, understanding of the community's economic, social, and cultural background will help determine meaningful suggestions and strategies for economic development opportunities.

The ground truthing exercise was used not only to improve the accuracy of the 1990 IMPLAN data, but also the accuracy of the 1982 data. We found ground truthing the 1982 data was more difficult and less successful. While local people are very aware of the current employment structure, they often do not have accurate and detailed pictures of that structure as it existed approximately a decade earlier. About the best that can be hoped for is a picture of major industries in the region for the period in question. Because 1982 IMPLAN data are acknowledged to be less accurate than 1990 data, the difficulty of ground truthing the 1982 data introduces some weakness into that part of the analysis.

The next step is to adjust IMPLAN's depiction of the rural community economy's employment and production structure so it corresponds to results of the ground truthing exercise. One way to change the IMPLAN regional database is by using IMPLAN's internal editor (see Taylor and others 1993, p. 3-12). A more efficient method is to use IMPLAN/Q, a product offered by QUARTET SYSTEMS INC, Haydenville, MA 01039). IMPLAN/Q allows the IMPLAN regional database to be imported into a spreadsheet, where it is much easier to make changes. Once the changes are made, the modified data in the spreadsheet can be exported back to IMPLAN for subsequent regional model building.

Employment, all components of value added and total industrial output for each sector in the model, should be modified as appropriate. Change all of these variables in proportion to the change between the original sector employment and final sector employment resulting from the ground truthing exercise. This assumes that the production information summarized in the IMPLAN regional account is correct, except for level of employment and other supply side variables such as output and value added. In this way, the supply side of the regional model can be made as accurate as possible, given a limited amount of time (2 weeks in this study) allocated to the model building exercise.

It should be noted that beginning with the 1993 data, the Minnesota IMPLAN group is controlling the IMPLAN data to REIS 2-digit SIC data so the match between IMPLAN and REIS at this level of aggregation should be close. The process of ground truthing the data for individual IMPLAN sectors should become easier.

**Other Considerations to Improve Trade Estimates**—We made no attempt to alter the regional purchase coefficients (see Taylor and others 1993, p. 3-19) or any of the regional demand-side estimates generated by IMPLAN. Nor were any of the regional production functions altered, other than to proportionally increase or decrease all components of regional supply. Each of these aspects of the regional model could be improved with additional effort.

For example, it is unlikely that rural households have consumption functions identical to the national, aggregate consumption functions represented in IMPLAN. However, recognizing this problem is far from solving it. Needed consumption data are not readily available, and fairly extensive research would be required to generate data applicable to rural households.

The regional purchase coefficients in IMPLAN can also be a problem. Regional purchase coefficients show the proportion of regional demand supplied from local sources and may be easily corrected in the IMPLAN model construction process. The problem is that there are literally hundreds of regional purchase coefficients for any given model and it is difficult to know the correct value for a given commodity. However, in any economy, certain sectors are obvious candidates for special attention.

Resource processing sectors, such as ore processing, are usually characterized by a large, intermediate demand for the raw material being processed. In the case of gold mining and processing, for example, there is a large, intermediate demand for gold ore. In the case of sawmills, there is a large demand for logs. With the IMPLAN methodology, large regional demands tend to lead to large commodity imports unless the regional purchase coefficients for that commodity is

very close to one. For mining sectors processing locally mined ore, IMPLAN import estimates of mined ore are likely overstated (an example illustrates this problem later in the text). In a case where the imports of a commodity are known to be close to zero, the regional purchase coefficients should be increased as needed to properly estimate (reduce) imports.

With other sectors, it is likely that the IMPLAN regional purchase coefficients will need to be reduced. For example, in small rural places the hotel and lodging places sector sells much of its services to tourists and hence is exported; this sector's regional purchase coefficients should be close to zero.

Production functions in an IMPLAN-based regional model are easy to review. National estimates of jobs per million dollars of industrial output by sector are also available from the IMPLAN data system. Construct the input-output accounts for the U.S. economy, then produce report (MID.901B). Output/labor ratios can be calculated for the "corrected" rural community model and compared to national figures (MID.901B).

If the regional output per job ratio is substantially different than the national ratio for a given sector, it is possible that regional data are in error and need to be reconciled with national figures. The same logic applies to estimates of wages-per-job and estimates of other property income per unit of output. This discussion does not imply that any deviation of regional data from national data should be treated as an error. Rather, such deviations should be treated with suspicion and carefully reviewed.

Although we did not attempt to change the IMPLAN regional purchase coefficients nor the configuration of any of the regional production functions, we feel that some attention to these details and possible corrections would have provided additional accuracy of regional trade flow estimation. An additional week to further refine production estimates through review of the regional production functions and to review possible problem regional purchase coefficients would very likely have been worth the improved results. In

**Table 1**—Oneida County factor income, by industry, 1990 and 1982<sup>a</sup> (from Report MID.107).

Industry	1990 Regional factors					Employment
	Employee compensation	Indirect business taxes	Proprietary income	Other property income	Total value added	
----- Millions of 1990 dollars -----						
Government	5.7718	0	0	0	5.7718	312
Food and feed grains	0.8866	0.5045	3.07	8.0604	12.5315	201
Trade (all)	1.3194	0.6456	0.3122	0.2	2.4774	159
Eating and drinking	0.3432	0.0683	0.0273	-0.0617	0.3771	67
Ranch fed cattle	0.7895	0.4788	2.9725	-0.5756	3.6652	66
Nonmetallic minerals, N.E.C.	2.1516	0.2931	0.0308	5.6251	8.1006	62
Banking	1.0288	0.0502	0.0304	0.6067	1.7161	51
Hospitals	1.3952	0.0109	0	0	1.4061	74
Other industries	4.9594	1.7552	3.6285	-0.3224	10.0209	357
Total	18.6455	3.8066	10.0817	13.5325	46.0667	1,348
Per job	13,832	2,824	7,479	10,039	34,174	
1982 Regional factors						
Government	3.0616	0	0	0	3.0616	253
Food and feed grains	0.7052	0.3081	3.3179	1.3843	5.7152	251
Trade (all)	2.0248	0.6484	0.1379	0.3492	3.1604	221
Eating and drinking	0.3386	0.0476	0.0255	0.0631	0.4749	56
Ranch fed cattle	0.6038	0.2069	0.2249	0.0924	1.1282	86
Nonmetallic minerals, N.E.C.	1.0595	0.1923	-0.0138	0.6352	1.8731	36
Banking	1.0957	0.0471	0.0028	0.5194	1.665	36
Hospitals	0.3237	0	0.0055	0.0033	0.3327	39
Other industries	5.4629	1.1403	1.8916	5.1553	13.6498	347
Total	14.6759	2.5907	5.5923	8.2021	31.0609	1,325
Per job	11,075	1,995	4,220	6,190	23,440	

<sup>a</sup>Definitions: Other property income: depreciation allowances and corporate profits; employment: jobs; indirect business taxes: sales and excise taxes; employee compensation: wages and salaries; proprietary income: includes returns to self-employed business persons.

general, model building and correction should be allocated 3 weeks to 1 month of time.

**Comparing Regional Economic Flow Estimates Over Time**—There are two main problems with comparing IMPLAN regional output estimates over time. The first involves comparison of real dollar (adjusted for inflation) flows from year to year. Flow estimates, such as commodity supply or demand, involve changes in both quantities and prices. To examine changes in real flows over time requires a common price standard (a base year). We used deflators based on the 1990 Producer Price Index to adjust 1982 commodity sales estimates to 1990 dollars; see appendix H in the Micro IMPLAN Users Guide (Taylor and others 1993). Estimates of factor income and regional value added for 1982 were adjusted by using the 1990 Consumer Price Index to more nearly reflect real changes in these variables.

The second major problem with direct comparison of regional economic variables between 1982 and 1990 is that the IMPLAN sectoring scheme was changed. This change complicates efforts to use the longitudinal aspects of the IMPLAN system when comparing regional output over time. Cross-time comparisons must be reduced to a common sectoring scheme representative of both time periods. A spreadsheet template was developed to aggregate all sectors involved in the sector redefinition (sectors not directly comparable between 1982 and 1990). Because of this, the maximum number of comparable sectors dropped from 528 to 467, which is still quite detailed. Some of the sectors that lost detail are located in the mining group in 1982. In 1990, sector detail is lost in retail trade (all), government, and miscellaneous other sectors. The aggregation procedure used follows the IMPLAN 1990 to 1985 Bridge Scheme as described in the Micro IMPLAN Users Guide (Taylor and others 1993).

## Results—The Case of Malad City, ID

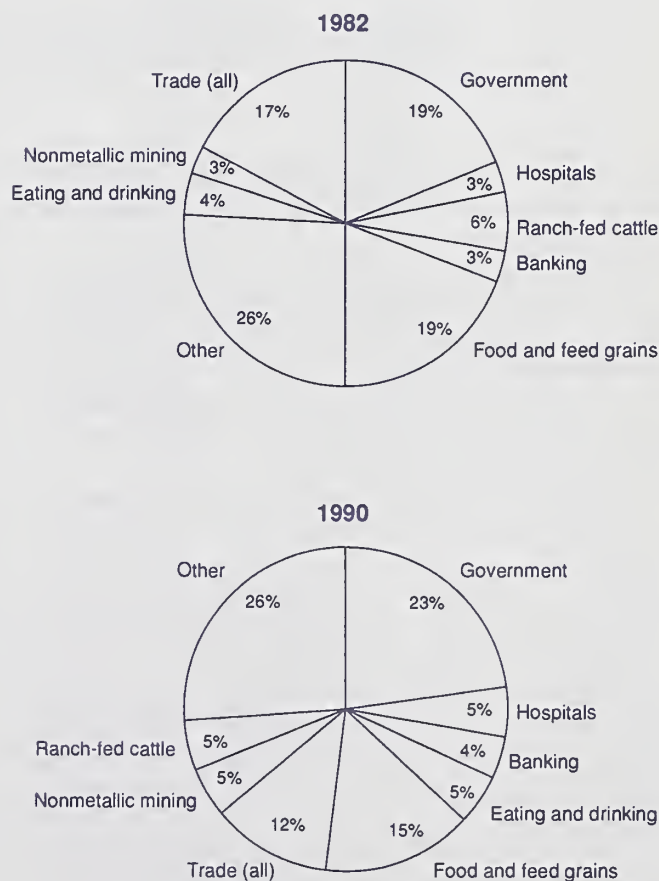
The following discussion presents some estimates from the input-output accounts and illustrates the use of those estimates to identify development opportunities in the case of Malad City, ID, one of the case study communities. Located in southern Idaho, Malad City is a small but economically dominant community in Oneida County. Because of this dominance, county data largely reflect the trade and service functions of Malad City.

### Export Base

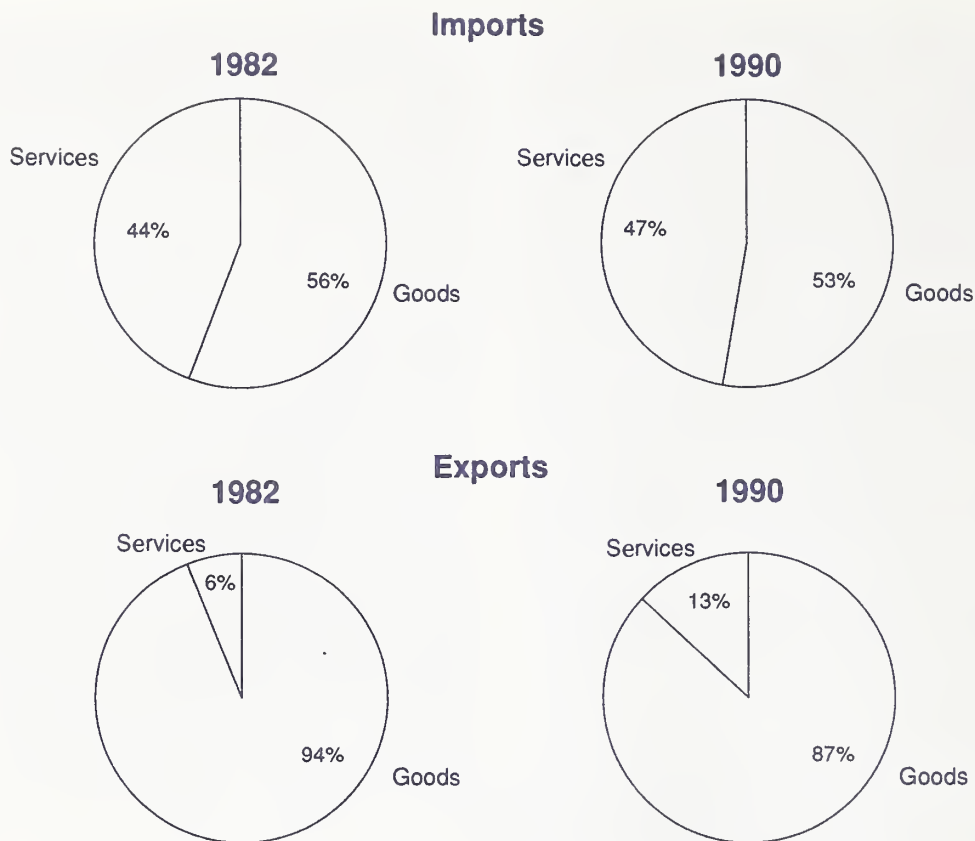
Total employment remained nearly constant between 1982 and 1990 (table 1 and fig. 1—all tables and figures were constructed from the corrected IMPLAN

accounts), but the industrial composition of that employment changed substantially. Agricultural employment declined. Two major parts of agricultural employment (food and feed grains and ranch fed cattle) declined from 25 percent of total employment in 1982 to 20 percent of total employment in 1990 (fig. 1). The percent of the labor force employed in wholesale and retail trade also declined, from 17 percent in 1982 to 12 percent in 1990 (fig. 1). We believe that local wholesale and retail functions were harmed by the U.S. Department of Agriculture's Conservation Reserve Program started in the 1980's (to be discussed later) and changes in regional shopping patterns as an increasing share of household purchases were made in the larger trade centers of Salt Lake City and Logan, UT, to the south and Pocatello, ID, to the north.

Government employment (local, State, and Federal) and other service employment were the growth sectors. Government employment expanded from 19 percent of total jobs in 1982 to 23 percent in 1990. The service sectors of banking, eating and drinking, and hospitals expanded from 10 percent of the employment base in 1982 to 14 percent of the base in 1990. Real wages per job in Oneida County (Malad City)



**Figure 1**—Oneida County employment by industry, 1982 and 1990.



**Figure 2**—Oneida County total commodity imports and exports 1982 and 1990 (millions 1990 dollars).

increased by one-fourth between 1982 and 1990 (table 1). This is a function of the industry mix of the regional economy.

Figure 2 presents an overview of the import-export pattern of the economy. As expected, exports are dominated by goods-producing industries, but service exports are becoming more important. In fact, in real terms (1990 dollars) goods exports are estimated to have declined between 1982 and 1990, while services exports more than doubled (fig. 2).

The export base of the Oneida County economy is summarized in table 2. The importance of agriculture and mining to the export base is revealed in the fact that nine out of the top-ten exported commodities were either agricultural or mining. Banking services (Sector 456) is the notable exception.

Nearly all of the top-ten exports are in raw product form. Only meat packing plant products (Commodity 58) and Minerals (Commodity 250) are somewhat processed, in the sense of adding value to the raw product. Given the high exports of ranch fed cattle (Commodity 3), it may be possible to find special niche markets for grass-fed beef in nearby urban markets. This would mean that the product of the ranch fed cattle sector would leave the region not as calves, but

as processed grass-fed beef. Urban households are looking for leaner beef produced in a more natural way so organically grown beef now sells at a premium. It may be possible to add marketing and processing services to range fed cattle and exploit markets in Salt Lake City, Logan, and Pocatello.

While the export base of the economy is strongly goods oriented, it would be a mistake to forget that selected service sectors are making an export contribution as well, and should be properly considered a part of the regional export base. Despite its small size, Malad City has a relatively large banking industry. Banking (Commodity 456) is estimated to export over \$1.3 million in services. Agricultural and forestry (Commodity 26) services are exporting nearly \$1.0 million in services. Management and consultant (Commodity 508) services are also being exported, although at a much smaller rate (\$0.13 million). The point is, selected service sectors should be viewed as legitimate parts of the export base in rural communities; in the case of Malad City, service exports have been growing at a higher rate than most goods exports (fig. 2). In the West, service firms such as management and consultant services may be attracted to natural resource-based amenities. Such firms are able to benefit from

**Table 2**—Oneida County top commodity exports, 1990 (from report MID.005 and MID.002).

Commodity sector	Commodity name	Domestic exports	Foreign exports	Total export
----- Millions of dollars -----				
11	Food grains	3.9441	4.7593	8.7034
47	Miscellaneous nonmetallic minerals, N.E.C.	6.0507	0.8691	6.9198
12	Feed grains	4.2743	1.2769	5.5512
3	Ranch fed cattle	3.8208	0.0009	3.8217
250	Minerals, ground or treated	2.3853	0	2.3853
58	Meat packing plants	1.7119	0.0028	1.7147
1	Dairy farm products	1.3256	0.0594	1.385
456	Banking	1.1933	0.179	1.3723
13	Hay and pasture	1.3115	0.0176	1.3291
4	Range fed cattle	0.9338	0.0009	0.9347
26	Agricultural, forestry, fishery services	0.892	0.0116	0.9036
387	Truck trailers	0.5615	0.0496	0.6111
491	Nursing and protective care	0.4272	0	0.4272
354	Industrial machines, N.E.C.	0.4042	0	0.4042
59	Sausages and other prepared meats	0.3332	0	0.3332
65	Fluid milk	0.2114	0	0.2114
9	Miscellaneous livestock	0.1474	0.0316	0.179
508	Management, consulting, residential, development, and testing services	0.1181	0.0165	0.1346
41	Sand and gravel	0.1221	0	0.1221
467	Funeral service and crematories	0.1148	0	0.1148
485	Bowling alleys and pool halls	0.1082	0	0.1082
42	Clay, ceramic, refractory minerals, N.E.C.	0.0922	0	0.0922
507	Accounting, auditing, and bookkeeping	0.0866	0.0005	0.0871
439	Arrangement of passenger transportation	0.0556	0.0131	0.0687
447	Wholesale trade	0	0.0638	0.0638
6	Sheep, lambs, and goats	0.0367	0.0053	0.042
500	Social services, N.E.C.	0.0404	0.0005	0.0409
174	Newspapers	0.0311	0.0007	0.0318
440	Transportation services	0.0275	0.0029	0.0304
89	Animal and marine fats and oils	0.03	0	0.03
40	Dimension stone	0.0286	0	0.0286
14	Grass seeds	0.0277	0.0005	0.0282
482	Miscellaneous repair shops	0.0212	0.0054	0.0266
462	Real estate	0	0.0199	0.0199
24	Forestry products	0.0182	0	0.0182
455	Retail trade (all)	0.0152	0.0004	0.0156
176	Book publishing	0.0155	0	0.0155
517	Scrap	0.0147	0	0.0147
459	Insurance carriers	0.0064	0.0082	0.0146
433	Railroads and related services	0	0.0145	0.0145

the revolution in communications technology and have already located in Malad City. This sector may deserve special attention as a target for future expansion.

One final note regarding possibilities for export-base expansion: Malad City sits next to a major north-south interstate highway (Interstate 15). This location gives quick and reliable access into the major markets provided by Pocatello and Salt Lake City and is probably a major factor in explaining the growth of imported retail trade services in Oneida County. Households in the region have found it convenient and cost effective to do their shopping in the major urban

centers. The result has been, and will continue to be, increased competition for local retailers.

The flip side to this coin is the possibility of Malad City attracting business or households from these same urban centers. Malad City offers the advantage of small-town living with quick access to the city. A possible target group is retirees in Salt Lake City who have cultural or family ties to Salt Lake City, but would like to escape the city.

It should also be remembered that Malad City is in Idaho and may offer a tax or regulatory environment that may be attractive to firms currently located and

doing business in Utah. Border counties that have found a Utah business niche include those located in Nevada where gambling is legal.

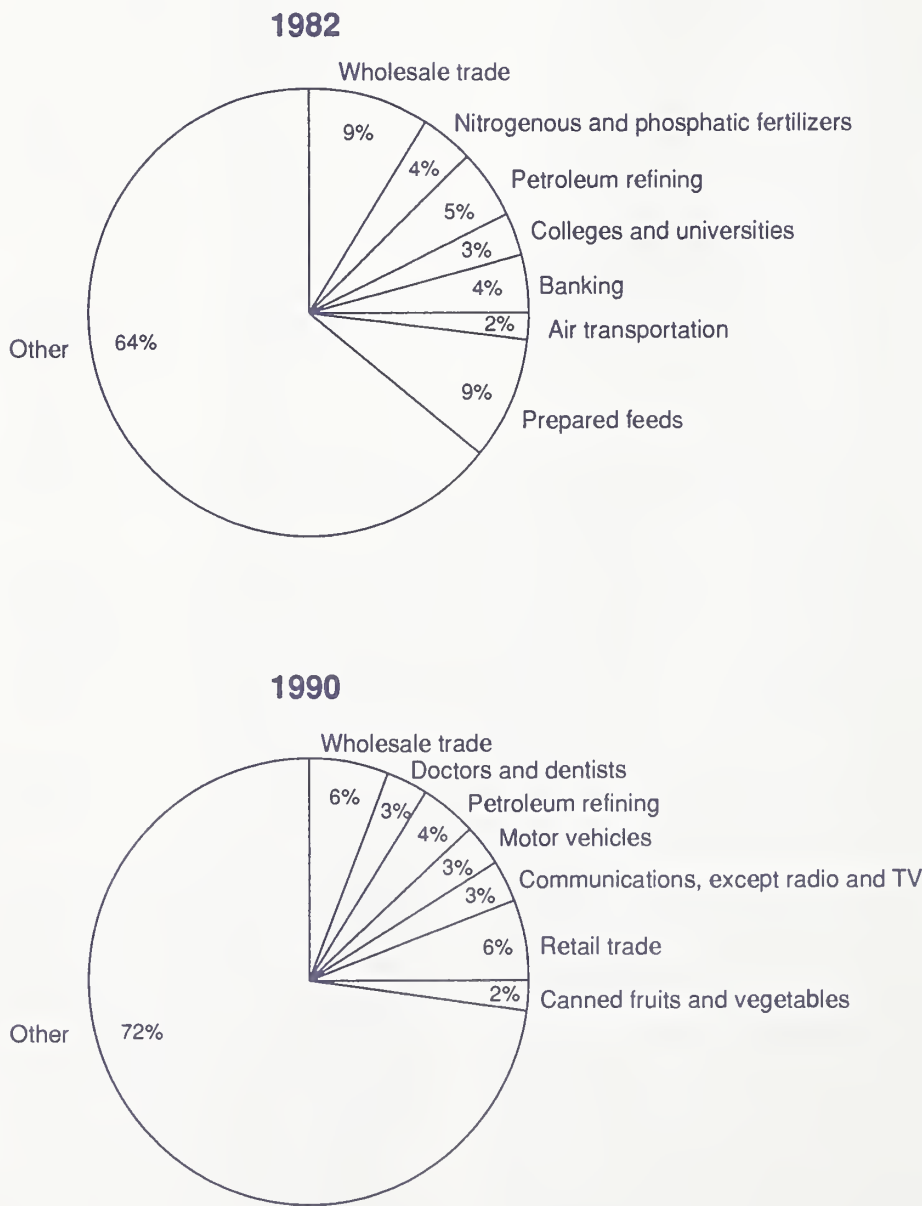
### Import Substitutions

The import structure of the regional economy is summarized in figure 3. As expected, goods such as petroleum refining (Commodity 210) and motor vehicles (Commodity 384) are near the top of the imports list (table 3); but, for reasons noted previously, are not promising candidates for import substitution.

Wholesale trade (Commodity 447) stands as the top import, importing \$2.47 million of services in 1990. In

input-output accounting, marketing services provided by wholesalers are unbundled from the purchaser price of imported goods and are shown as an imported service. For example, refined petroleum products consumed in Malad City are imported from outside the region. Filling stations that sell these products capture the retail marketing margin, but the wholesale marketing margin and fuel cost are captured by outside bulk dealers and refineries that sold the product to the filling stations. Those wholesale marketing services and the fuel are viewed as imports in the input-output accounts.

The import bill of economically small rural regions will usually indicate large expenditures for wholesale



**Figure 3**—Oneida County imports by commodity, 1982 and 1990.

**Table 3**—Oneida County top commodity imports, 1990 (from Report MID.005).

Commodity sector	Commodity name	Net commodity supply	Gross commodity demand	Total commodity imports
----- Millions of dollars -----				
447	Wholesale trade	0.5122	2.9827	2.4705
455	Retail trade (all)	2.4671	4.6422	2.1904
210	Petroleum refining	0.0196	1.6564	1.6564
443	Electric services	0.4546	1.8036	1.3491
490	Doctors and dentists	0.6389	1.9496	1.3107
441	Communications, except radio and TV	0	1.1711	1.1711
384	Motor vehicles	0.0054	1.1632	1.1578
67	Canned fruits and vegetables	0	0.7695	0.7695
47	Miscellaneous nonmetallic minerals, N.E.C.	11.0903	5.8016	0.762
492	Hospitals	2.0101	2.7312	0.7211
124	Apparel made from purchased materials	0	0.6699	0.6699
444	Gas production and distribution	0.0755	0.7397	0.6642
494	Legal services	0.2023	0.7965	0.5943
12	Feed grains	4.3537	0.6438	0.5644
437	Air transportation	0.0295	0.5775	0.548
56	Maintenance and repair other facilities	0.5322	1.0766	0.5444
202	Nitrogenous and phosphatic fertilizers	0	0.534	0.534
195	Drugs	0	0.495	0.495
458	Security and commodity brokers	0.0371	0.5266	0.4895
496	Colleges, universities, schools	0.0054	0.4793	0.4739
454	Eating and drinking	1.0839	1.5478	0.4639
475	Computer and data processing services	0.0253	0.4764	0.451
479	Automobile repair and services	0.4447	0.8583	0.4136
460	Insurance agents and brokers	0.1961	0.5925	0.3964
7	Hogs, pigs, and swine	0.0605	0.4261	0.3657
49	New industrial and commercial buildings	0.4149	0.7749	0.36
5	Cattle feedlots	0.4547	0.784	0.3293
463	Hotels and lodging places	0.3557	0.6825	0.3268
457	Credit agencies	0.0003	0.2789	0.2786
469	Advertising	0.1052	0.3829	0.2777
59	Sausages and other prepared meats	0.3447	0.2891	0.2776
186	Miscellaneous chemicals, gas, pigments, N.E.C.	0.0003	0.2711	0.2711
470	Other business services	0.0324	0.2896	0.2572
500	Social services, N.E.C.	0.5747	0.7912	0.2568
95	Bottled and canned soft drinks and water	0	0.256	0.256
386	Motor vehicle parts and accessories	0.0193	0.2728	0.2535
204	Agricultural chemicals, N.E.C.	0	0.253	0.253
508	Management consulting, residential, development, and testing services	0.2517	0.3737	0.2401
65	Fluid milk	0.2247	0.251	0.2377
104	Cigarettes	0.0002	0.2191	0.2189

trade services. This does not necessarily mean that such services are good candidates for import substitution; these services often demand a large volume and a central place location that the rural community cannot provide.

One example of a sector that may be a good candidate for import substitution in Malad City is doctor and dental (Commodity 490) services. In 1990 the community demanded nearly \$2 million in services; only \$0.6 million was supplied locally (table 3); \$1.31 million was supplied by imports. (A service, such as

doctors and dentists, will be shown to be imported in the input-output accounts when local residents drive outside the region to obtain the service.) Also, imports of these services grew very rapidly from 1982 to 1990, increasing from \$0.1 million to \$1.3 million (table 4). Although, many medical services are highly specialized and cannot be supplied in a rural community, it is possible that excess demand for medical services could be supplied by a general practitioner. (Excess demand is the positive difference between gross commodity demand and net commodity supply.)

**Table 4**—Oneida County commodity imports with most positive change, 1982-1990 (from Report MID.005).

Commodity sector	Commodity name	Total 1982 imports	Total 1990 imports	1982-1990 import change	Annual percent change
----- Millions of 1990 dollars -----					
455	Retail trade (all)	0.5238	2.1904	1.6666	17.88
490	Doctors and dentists	0.0978	1.3107	1.2129	32.45
47	Miscellaneous nonmetallic minerals, N.E.C.	0.0002	0.762	0.7618	103.03
67	Canned fruits and vegetables	0.1181	0.7695	0.6514	23.43
12	Feed grains	0	0.5644	0.5644	
454	Eating and drinking	0	0.4639	0.4639	
460	Insurance agents and brokers	0	0.3964	0.3964	
492	Hospitals	0.3416	0.7211	0.3795	9.34
384	Motor vehicles	0.7894	1.1578	0.3684	4.79
7	Hogs, pigs, and swine	0	0.3657	0.3657	
479	Automobile repair and services	0.0504	0.4136	0.3632	26.32
5	Cattle feedlots	0	0.3293	0.3293	
463	Hotels and lodging places	0	0.3268	0.3268	
457	Credit agencies	0	0.2786	0.2786	
444	Gas production and distribution	0.3935	0.6642	0.2707	6.54
65	Fluid milk	0	0.2377	0.2377	
124	Apparel made from purchased materials	0.4511	0.6699	0.2189	4.94
55	Maintenance and repair, residential	0	0.2175	0.2175	
220	Miscellaneous plastics products	0	0.2173	0.2173	
195	Drugs	0.2791	0.495	0.2159	7.16
1	Dairy farm products	0	0.1947	0.1947	
470	Other business services	0.0821	0.2572	0.1751	14.28
434	Local, interurban passenger transit	0.042	0.2024	0.1604	19.67
466	Beauty and barber shops	0	0.149	0.149	
504	Labor and civic organizations	0.0794	0.2271	0.1477	13.14
179	Commercial printing	0.0645	0.1986	0.1341	14.06
518	Used and secondhand goods	0.0218	0.153	0.1312	24.36
27	Landscape and horticultural services	0.055	0.1847	0.1297	15.14
497	Other educational services	0	0.1228	0.1228	
176	Book publishing	0.0681	0.1778	0.1098	12.01
13	Hay and pasture	0	0.1013	0.1013	
487	Racing and track operation	0.0318	0.1306	0.0988	17.66
48	New residential structures	0.0326	0.1299	0.0973	17.28
174	Newspapers	0.0088	0.0998	0.091	30.36
494	Legal services	0.5049	0.5943	0.0894	2.04
503	Business associations	0.0311	0.1188	0.0878	16.77
77	Dog, cat, and other pet food	0.0546	0.1396	0.085	11.74
95	Bottled and canned soft drinks and water	0.1774	0.256	0.0786	4.58
501	Residential care	0.0447	0.1222	0.0775	12.57
386	Motor vehicle parts and accessories	0.1797	0.2535	0.0737	4.3

Another candidate for import substitution may be the services of security and commodity broker (Commodity 458). Demand (\$0.5 million) in 1990 again exceeded local supply (\$0.03 million) (table 3). This is a service where the revolution in communications technology has minimized the disadvantage of distance from financial centers. There may be opportunity for a one- or two-person branch office of a major security or commodity firm. Whether this is truly a viable business opportunity would require a feasibility analysis.

Table 5 shows those commodities where imports went down from 1982 to 1990. The negative impact of selected Federal government programs on imports, as well as changes in consumer tastes are revealed. The U.S. Department of Agriculture, Conservation Reserve Program, which entitled participating farmers to retire farmland from production, in exchange for a payment from the Federal government, caused a decline in farming activity with corresponding decline in the use of agricultural inputs. In Oneida County, manufactured agricultural inputs used by

**Table 5**—Oneida County commodity imports with most negative change, 1982-1990 (from Report MID.005).

Commodity sector	Commodity name	Total 1982 imports	Total 1990 imports	1982-1990 import change	Annual percent change
----- Millions of 1990 dollars -----					
78	Prepared feeds, N.E.C.	4.2651	0.1862	-4.0789	-39.14
447	Wholesale trade	4.1629	2.4705	-1.6924	-6.52
456	Banking	1.6972	0.1475	-1.5497	-30.54
441	Communications, except radio and TV	2.3386	1.1711	-1.1675	-8.65
202	Nitrogenous and phosphatic fertilizers	1.6701	0.534	-1.1362	-14.25
459	Insurance carriers	0.9218	0.148	-0.7738	-22.86
496	Colleges, universities, schools	1.2061	0.4739	-0.7321	-11.68
500	Social services, N.E.C.	0.9817	0.2568	-0.7249	-16.76
210	Petroleum refining	2.3447	1.6564	-0.6884	-4.34
482	Miscellaneous repair shops	0.6937	0.0135	-0.6802	-49.21
309	Farm machinery and equipment	0.7714	0.0979	-0.6735	-25.8
50	New utility structures	0.8304	0.1757	-0.6547	-19.41
58	Meat packing plants	0.7792	0.2119	-0.5673	-16.28
49	New industrial and commercial buildings	0.8515	0.36	-0.4915	-10.76
437	Air transportation	1.0255	0.548	-0.4775	-7.83
87	Soybean oil mills	0.4211	0.0529	-0.3682	-25.92
508	Management, consulting, residential, development, and testing services	0.6037	0.2401	-0.3636	-11.53
26	Agricultural, forestry, fishery services	0.3679	0.019	-0.349	-37.05
21	Oil bearing crops	0.3231	0.0008	-0.3223	-75.65
51	New highways and streets	0.3775	0.0892	-0.2883	-18.04
473	Equipment rental and leasing	0.3904	0.1337	-0.2567	-13.4
59	Sausages and other prepared meats	0.4953	0.2776	-0.2177	-7.24
8	Other meat animal products	0.2269	0.0092	-0.2177	-40.03
204	Agricultural chemicals, N.E.C.	0.456	0.253	-0.203	-7.37
474	Personnel supply services	0.3514	0.1568	-0.1946	-10.09
331	Construction and special industry machinery, N.E.C.	0.1838	0.0141	-0.1697	-32.09
213	Lubricating oils and greases	0.1964	0.0407	-0.1557	-19.67
435	Motor freight transport and warehousing	0.3366	0.1928	-0.1438	-6.96
215	Tires and inner tubes	0.3132	0.17	-0.1431	-7.63
475	Computer and data processing services	0.592	0.451	-0.141	-3.4
254	Blast furnaces and steel mills	0.2384	0.0978	-0.1406	-11.14
10	Cotton	0.1327	0	-0.1327	0
477	Automobile rental and leasing	0.1726	0.0549	-0.1177	-14.32
491	Nursing and protective care	0.1508	0.0334	-0.1174	-18.83
379	Storage batteries	0.1304	0.0163	-0.1141	-26
436	Water transportation	0.1656	0.0587	-0.1069	-12.97
60	Poultry processing	0.2197	0.1221	-0.0977	-7.35
104	Cigarettes	0.3146	0.2189	-0.0957	-4.53
507	Accounting, auditing, and bookkeeping	0.1159	0.0268	-0.0891	-18.31
81	Sugar	0.1231	0.0515	-0.0716	-10.89

local agriculture are largely imported. Between 1982 and 1990, there was a large reduction in imports of nitrogenous and phosphatic fertilizers (Commodity 202), prepared feeds (Commodity 78), farm machinery and equipment (Commodity 309), and petroleum refining (Commodity 210) (table 5). These products were supplied by dealers outside the local economy. Thus, the nonlocal businesses involved in marketing these agricultural inputs experienced a loss in business.

This is reflected by the loss in imports of wholesale trade (Commodity 447) (table 5).

Shifts in consumer demand are illustrated by the changes in imports of cigarettes (Commodity 104) and sugar. Cigarette imports, and hence consumption, declined by nearly one-third (table 5) between 1982 and 1990, even though population in the county increased by slightly over 6 percent. During that same period, imports of sugar declined (Commodity 81) by

over 50 percent. Assuming that households are the main consumers of sugar in Oneida County, the reduction in sugar use is accounted for by increased use of sugar substitutes and by a reduction in demand for sugar.

## Rural-Urban Linkages

Regional model results for the Salt Lake central place (Cache, Weber, Davis, and Salt Lake) counties are summarized in tables 6 and 7 and reveal the immensity of this economy. For example, \$1.3 billion

of natural gas and crude petroleum (Commodity 38) is estimated to be imported into the region (table 6). In fact, goods imports are so large that even the smallest commodity import in table 6 is far larger than required for a market between Malad City and Salt Lake City.

A possible problem with model construction and the nonadjustment of the regional purchase coefficients should be noted. The central place region is revealed to be a major supplier of copper ore (Commodity 29) with \$537 million of production (table 6).

**Table 6**—Logan and Salt Lake City, UT, top goods imports, 1990 (from Report MID.005).

Commodity sector	Commodity name	Net commodity supply	Gross commodity demand	Total commodity imports	Domestic commodity exports
----- Millions of dollars -----					
38	Natural gas and crude petroleum	172.3362	1359.947	1359.946	172.3358
384	Motor vehicles	148.3022	471.7606	395.705	72.2466
220	Miscellaneous plastics products	169.5503	296.9429	295.727	168.3344
1	Dairy farm products	58.6298	281.8833	258.5463	35.2928
254	Blast furnaces and steel mills	14.0936	178.1582	169.7697	5.7051
124	Apparel made from purchased materials	92.792	260.3018	167.5099	0
262	Primary nonferrous metals, N.E.C.	161.3971	185.177	162.8584	139.0786
186	Miscellaneous chemicals, gas, pigments, N.E.C.	134.6279	240.7627	155.7096	49.5747
195	Drugs	47.0135	194.3173	147.3038	0
29	Copper ores	537.6664	361.5181	141.3613	317.5096
386	Motor vehicle parts and accessories	234.5013	231.119	128.364	131.7462
162	Paper mills, except building paper	0.741	128.1917	128.1917	0.7409
389	Aircraft	21.8103	133.9239	127.6975	15.584
391	Aircraft and missile equipment, N.E.C.	68.0345	127.3024	127.3024	68.0345
339	Electronic computers	325.5949	397.1705	122.4889	50.9133
3	Ranch fed cattle	19.0061	134.2479	115.2418	0
159	Blinds, shades, and drapery hardware	0	110.287	110.287	0
179	Commercial printing	135.0676	138.9833	108.8263	104.9106
396	Complete guided missiles	21.3573	107.5806	107.5806	21.3573
354	Industrial machines, N.E.C.	104.7811	105.5836	105.583	104.7804
5	Cattle feedlots	14.9614	109.8906	94.9292	0
95	Bottled and canned soft drinks and water	101.3766	97.0987	93.6533	97.9313
399	Transportation equipment, N.E.C.	115.8182	94.4497	89.7934	111.1618
59	Sausages and other prepared meats	113.7821	104.3194	89.2234	98.6860
191	Plastics, materials, and resins	21.0706	107.6398	86.5692	0
60	Poultry processing	1.8045	80.3554	78.5509	0
104	Cigarettes	0.1443	77.3302	77.3302	0.1443
108	Broad woven fabric mills and finishing	4.8235	70.5935	68.2477	2.4776
421	Sporting and athletic goods, N.E.C.	197.6651	99.8388	66.8938	164.7201
260	Primary copper	187.5249	74.1624	63.7885	177.1510
413	Photographic equipment and supplies	8.4907	71.2711	62.7804	0
215	Tires and inner tubes	0.3721	62.6289	62.6278	0.3710
58	Meat packing plants	407.7137	172.33	62.0376	297.4213
91	Malt beverages	2.8401	62.3398	61.9737	2.474
374	Communications equipment, N.E.C.	227.6202	185.999	60.7658	102.387
378	Electronic components, N.E.C.	141.0651	148.1018	59.1838	52.1471
199	Toilet preparations	17.2941	75.9976	58.7035	0
7	Hogs, pigs, and swine	1.4582	59.7229	58.2647	0
47	Miscellaneous nonmetallic minerals, N.E.C.	56.6943	59.194	57.906	55.4062
170	Sanitary paper products	6.6511	57.5238	57.5159	6.6432

However, the nonunitary regional purchase coefficients for this commodity leads to large estimated imports of copper ore for the Salt Lake region; these are likely in error. If this is an error, adjusting the regional purchase coefficients for copper ore in an upward direction could have corrected the problem by eliminating the estimated ore import.

One interesting commodity in the central place economy relating to excess demand is blinds, shades, and drapery hardware (Commodity 159) (table 6). There appears to be almost no local production,

although there was over \$110 million of regional demand. Very large imports are the result. Depending on the nature of the production function for these commodities, there may be prospects for producing these goods closer to Salt Lake City. Malad City may or may not be a good location for such production; additional study would be required.

The central place function of the Salt Lake region is also revealed in the data summarized in table 7. The region is a major supplier of wholesale trade (Commodity 447), hospital (Commodity 492) services,

**Table 7**—Logan and Salt Lake City, UT, top services imports, 1990 (from Report MID.005).

Commodity sector	Commodity name	Net commodity supply	Gross commodity demand	Total commodity imports	Domestic commodity exports
<i>----- Millions of dollars -----</i>					
462	Real estate	1319.542	1668.96	452.2933	102.8744
447	Wholesale trade	1385.256	1119.906	448.3554	713.7055
443	Electric services	631.1843	810.6259	306.6549	127.2134
441	Communications, except radio and TV	662.8663	656.3771	251.737	258.2263
492	Hospitals	987.8605	964.3385	232.8974	256.4194
459	Insurance carriers	486.4382	546.8733	193.8015	133.3664
454	Eating and drinking	626.5965	586.6265	186.7959	226.766
490	Doctors and dentists	721.895	708.9957	174.4066	187.3058
496	Colleges, universities, schools	46.7878	206.9587	160.1709	0
435	Motor freight transport and warehousing	745.8306	486.761	155.9178	414.9873
444	Gas production and distribution	754.8148	355.614	153.414	552.6148
469	Advertising	470.3624	472.6077	127.6258	125.3805
458	Security and commodity brokers	150.8932	275.4185	124.5253	0
456	Banking	572.576	633.8402	124.0609	62.7968
455	Retail trade (all)	1973.2786	1818.6515	114.2832	268.9102
437	Air transportation	510.9427	264.3062	112.1404	358.7769
494	Legal services	373.9482	435.1635	111.9571	50.7418
479	Automobile repair and services	462.8599	344.0999	111.2393	229.9992
500	Social services, N.E.C.	287.051	306.9031	108.4153	88.5632
475	Computer and data processing services	317.8436	313.909	84.7699	88.7044
508	Management, consulting, residential, development, and testing services	317.7863	302.9386	81.8074	96.655
460	Insurance agents and brokers	251.7728	229.4047	81.2967	103.6648
506	Engineering, architectural services	329.8024	275.372	70.8466	125.277
470	Other business services	240.2818	240.0925	64.836	65.0254
463	Hotels and lodging places	252.9697	293.0822	59.421	19.3085
507	Accounting, auditing, and bookkeeping	232.1584	224.9059	57.8629	65.1155
502	Other nonprofit organizations	148.5232	55.9024	55.9024	148.5232
518	Used and secondhand goods	8.7262	60.1643	51.4381	0
501	Residential care	22.215	47.5148	47.5148	22.215
445	Water supply and sewage systems	111.4298	111.0318	45.7584	46.1565
473	Equipment rental and leasing	77.8555	117.2225	39.367	0
474	Personnel supply services	121.1069	134.5647	36.3387	22.8809
438	Pipe lines, except natural gas	20.8713	53.7949	32.9236	0
483	Motion pictures	171.2321	160.3897	32.2274	43.0698
477	Automobile rental and leasing	83.5227	94.8911	30.676	19.3077
491	Nursing and protective care	96.2659	115.8839	27.9871	8.3691
436	Water transportation	0.8668	24.5537	23.6868	0
457	Credit agencies	190.1976	117.2866	22.9564	95.8674
466	Beauty and barber shops	37.9821	59.3802	21.3981	0
446	Sanitary services and steam supply	70.0343	50.6422	20.8706	40.2628

eating and drinking (Commodity 454), doctors and dentists (Commodity 490), and motor freight transport and warehousing (Commodity 435). Exports exceed imports for these services; the excess supply in some part is being exported to the Salt Lake trade area periphery; to places like Malad City.

The apparent anomaly of a lack of supply of colleges, universities, and schools (Commodity 496) services (table 7) in Salt Lake City is explained by noting that although the region contains major universities (Utah State University and the University of Utah), they happen to be public universities. As previously noted, colleges and universities (Commodity 496) sector of IMPLAN includes only private schools. IMPLAN data show there is a large excess demand for private university services in the region. This demand is currently being met by individuals migrating out of the region for private university schooling.

## Discussion

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In the process of conducting this study, we came to several conclusions. Some of these concern the link between economic analysis and rural development; others fall into the category of precautions.

### Economic Intelligence and Rural Community Development

Several suggestions can be made regarding a possible role of IMPLAN-based analysis in identifying rural development opportunities. It is clear that a detailed picture of the import structure and the export base of a region can be obtained. No other procedure offers this information and such information is potentially valuable. The question is: how can such information be integrated into the rural community development process?

Preferably, communities should be in early stages of an on-going process of rural development thinking and planning. It is not clear that this information is worth much to rural communities on a one-time, ad hoc basis. A number of meetings and discussions may be necessary before local people become sufficiently confident about the data and analysis to use this information in forming concrete plans. Certainly, the more local persons are involved in verifying and modifying IMPLAN accounts, the more confidence they will have in the subsequent results.

In fact, before spending a lot of time thinking about development strategies, it might make sense to educate the community regarding its overall economic structure and profile. This would include a review of the distribution of jobs by sector, average wage by sector, profits by sector, and taxes paid by sector. Information would be necessary on the growth or decline of various sectors both by sales and by employment. It would be

useful to supplement the IMPLAN data with REIS data showing the importance of unearned income, such as returns to capital and government transfers to households in the region. Building on this base, a discussion of strategies for rural economic development based on the ideas developed in this paper should be fruitful.

If the Forest Service wants to support increased rural economic development and planning, the kind of analysis we have just described can help provide the needed rationale. The IMPLAN system can provide a wealth of up-to-date regional economic intelligence. No other system can provide such a wealth of information on regional economic structure in combination with regional modeling capability. Information on the regional economic structure and ideas for economic development strategies can be developed in 2 to 4 weeks. The process of helping to integrate this information into public and private thinking regarding regional economic development is likely to take longer.

Our results were presented to a mixed audience consisting of local Forest Service personnel and community leaders. Though their backgrounds varied, none had rigorous knowledge of regional economic development concepts. No matter how good analyses may be, no matter how promising the development opportunities identified, the information is useless if these ideas and results are not communicated effectively, in a competent, professional manner. Several words and concepts need special attention if confusion is to be avoided. The concept of "region" was a problem. Regional economists use the term to describe any geographical area, but the audience invariably thought of a region as a very large piece of real estate (such as the Midwest) and certainly not less than several counties (such as southern Idaho). The concept of a "model" (as in an input-output model) also caused problems because many people do not think in terms of a set of equations that represents economic reality. Consider using the term "data" or "information" rather than model. And finally, regional economists think of "exports" as any activity that sells goods and services to markets outside the region, but many people think only in terms of international export trade. Beyond these easily misunderstood terms, effective communication must also illuminate strengths and weaknesses of the analysis and help people understand how these results fit into thinking about economic development.

### Caveats

Several features of this work have important implications for future work using IMPLAN to identify rural development opportunities. Because the analysis must take place at full 528-sector detail, model accuracy at that detail is critical. The bad news is

that the IMPLAN system is subject to error in economically small, rural regions. The good news is that these data problems are fairly easily corrected with the aid of on-the-ground review and additional secondary information.

The procedure we developed for ground truthing IMPLAN works well and should take no more than 3 or 4 days' time. Even additional time would be justified, in our view, in further refining the regional purchase coefficients and possibly modifying selected production functions.

We are less hopeful about using IMPLAN to generate comparisons in the regional economy over time. Two major problems exist with these comparisons. One is the difficulty of obtaining accurate regional models for periods before 1990. The ground truthing method is also weak when time has erased the ground and dulled memories.

The other difficulty is that cross-time comparisons with IMPLAN are complicated by commodity price changes and the lack of a common sectoring scheme. Although, we developed a methodology for making such comparisons, it remains a complicated and time-consuming process because so much of the analysis must take place outside of IMPLAN. Given a lack of confidence in the accuracy of the 1982 models at full 528 sector detail, the cross-time comparison becomes somewhat questionable.

Since our analysis can provide only an initial approximation of possible import substitution or export promotion opportunities, it may be most cost effective to present just the trade flow information based on the current period model. If the longitudinal analysis is developed, it should be accompanied by plenty of caveats warning of possible weakness and presented in a secondary role.

Regarding rural-urban linkages, the IMPLAN input-output model of central place economies should be fairly accurate because IMPLAN data are not subject to the disclosure problems that plague economically small rural counties. Urban place IMPLAN employment data, properly aggregated, and checked with REIS employment data for the same region, were virtually identical at the one-digit level of aggregation.

The problem with large central place economies is that they have such a large import bill that almost no screening in terms of possible import markets is possible. There was an import market for nearly all of the 528 goods and services measured in IMPLAN. Some screening is accomplished by examining changes in the import bill; however, such estimates as just noted are more difficult to construct and take more time to prepare.

An alternative that was not explored because of lack of time was rural-urban linkage analysis with intermediate-sized trade centers. Some of these places may offer expanding markets in selected goods and

services that this methodology could help discover. For example, instead of combining the Logan (Cache County) and Salt Lake City economies we could have constructed trade estimates for Logan separately, and conducted an analysis with Logan as the central place. Additional research will be required to explore the usefulness of this idea.

To make our procedures operational, rural development specialists need access to Forest Service personnel assigned specifically to the task of developing needed economic intelligence for selected regional economies. The job is too complicated for a casual analyst. This same person, being familiar with the intricacies of the IMPLAN, could work with community leaders and local Forest Service personnel to explain the implications of the analysis, promote a better understanding of the local economy, and discover concrete economic development strategies. Special reports could be developed for specific industries and household groups. The number of communities that one person could analyze would need to be limited, but the payoff in terms of real economic analysis and cost effective development, instead of what often amounts to blind economic boosterism, could well be worth the public sector cost.

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One aspect of rural community development is identifying economic development opportunities. Using the Forest Service's IMPLAN input-output accounts, this paper outlines procedures to identify development opportunities based on (1) expanding the export base, (2) substituting local production for imports, and (3) exploiting rural-urban linkages. Procedures and results from a case study are provided.

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**Keywords:** regional economics, economic development, community development, input-output analysis, economic base, import substitution

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